

MAKING AEROPLANING AS SAFE AS MOTORING

Development of the Gyroscope an Important Step in Solving Problem of Stabilizing Flying Machine

If the promise of recent experiments is fulfilled, aeroplaning is in a fair way to become pretty nearly as safe as motoring. This may seem to be a daring prophecy when one looks at the long list of aviation accidents. Here is the record of the last seven years:

Year	Accidents	Deaths
1908	1	1
1909	4	4
1910	20	32
1911	65	73
1912	93	108
1913	134	136
1914 (July 15)	53	76
Total	350	430

The most important piece of evidence in support of the prediction is perhaps the award in France the other day of the first prize, \$10,000, offered by the committee of the Concours de Sécurité to the Sperry Gyroscope Company of New York for its automatic aeroplane stabilizer. In that competition there were fifty-seven entrants. The automatic stabilizing of a flying machine is a problem bristling with difficulties, and its solution has been sought along a variety of lines.

In the recent competition in France, every country that has done anything in aviation was represented. Among the entrants was the Dunne machine, the invention of which much has been written. Briefly, the character of this biplane is such that the arrangement of the wings serves in a degree to maintain the equilibrium of the craft because of the inherent stability thus assured.

Also, the creation of M. Douthe was entered, this machine being cleverly stabilized fore and aft by means of a little palette which is sensitive to the wind pressure and automatically controls the stern or tail plane. Its purpose is mainly to guard against drops due to the failure of supporting pressure on the wings either through the stopping of the motor or a change of direction in the air currents. To this extent the Douthe apparatus is an automatic safety feature, but it does not provide against the disturbance of lateral stability.

The second prize was awarded to the biplane of Paul Schmitt, which is so arranged that the varying angles of the wings help to stiffen the poise of the craft in flight and to that measure make the aeroplane harder to upset.

It is singular that the Wright company was not represented, especially as the Aero Club of America awarded Orville Wright its trophy for the greatest achievement in aviation in 1913 because of his stabilizer.

Perhaps the explanation of the absence of the Wright device lies in its experimental state, because there does not seem to have been as yet any public demonstration of it in service. Again, according to published descriptions of the mechanism, its action hinges primarily upon the inspiration of pendulums, and the pendulum in the laboratory is a very different affair from a pendulum hung upon an aeroplane and susceptible of the disturbances peculiar to air craft. The great difficulty in employing a pendulum upon a flying machine is to arrest its oscillations as well as to temper its control to suit the individual problem presented by each oncoming gust of wind.

There are aviators who argue that a stabilizer is a confession of weakness of design in the machine. "That is to say," the aeroplane should have inherent stability of such a measure that the pilot should be without fear, knowing that his craft will right itself quickly though momentarily tossed about, in other words be practically a counterpart of a water borne raft, the raft rising and falling with the tumbling sea but with all its motion remaining topside up. Analogy gives an answer to this demand.

Early submarine boats had a tendency to plunge because of the low measure of stability fore and aft. Some of the boats were lost and lives sacrificed or endangered because of this crankiness. At once the cry was raised, "We must have stiffer boats," and the designers set about meeting the demand. The improvement in inherent stability brought in its train a number of tactical limitations, such as reduced speed and sluggishness of response to the sub-

merging rudders, and now the measure of inherent stability is being purposely cut down in order to gain in maneuvering efficiency.

The ideal air craft, then, should be one of flexible control and yet susceptible of satisfactory stabilizing. The Sperry gyroscope apparatus has been designed to meet the latter desideratum and has proved its capabilities.

An aviator must soon tire if he is operating in a gusty wind and seeks by manual or bodily control to steady his craft. At best, he is conscious of the need of action only after his machine has acquired a considerable angle of lateral heel or horizontal inclination. Could he but feel the first efforts of the tipping force, he could, by a slight adjustment of the proper planes, check the rocking motion in its very beginning.

This is really the gift which the bird possesses, especially the soaring birds, which circle through the air much after the fashion of the mechanical flier of to-day. Nature has given them an exquisite sense of balance and they have feeling to the uttermost tips of their wings. The aviator, on the other hand, sits at the centre of his craft; is at the point where there is least motion; and accordingly is not aware of the need of corrective action until the aeroplane has acquired a considerable degree of angular motion.

Col. Etie of the French service sought to overcome this human shortcoming by means of a little apparatus which would warn the aviator quickly and indicate to him the compensating manoeuvre to be made. However, it put the burden of safety ultimately upon the pilot and in no way lessened the nervous strain; indeed, the frequency of these mechanical cautionings were enough, in themselves, to keep him in a state of exhausting suspense.

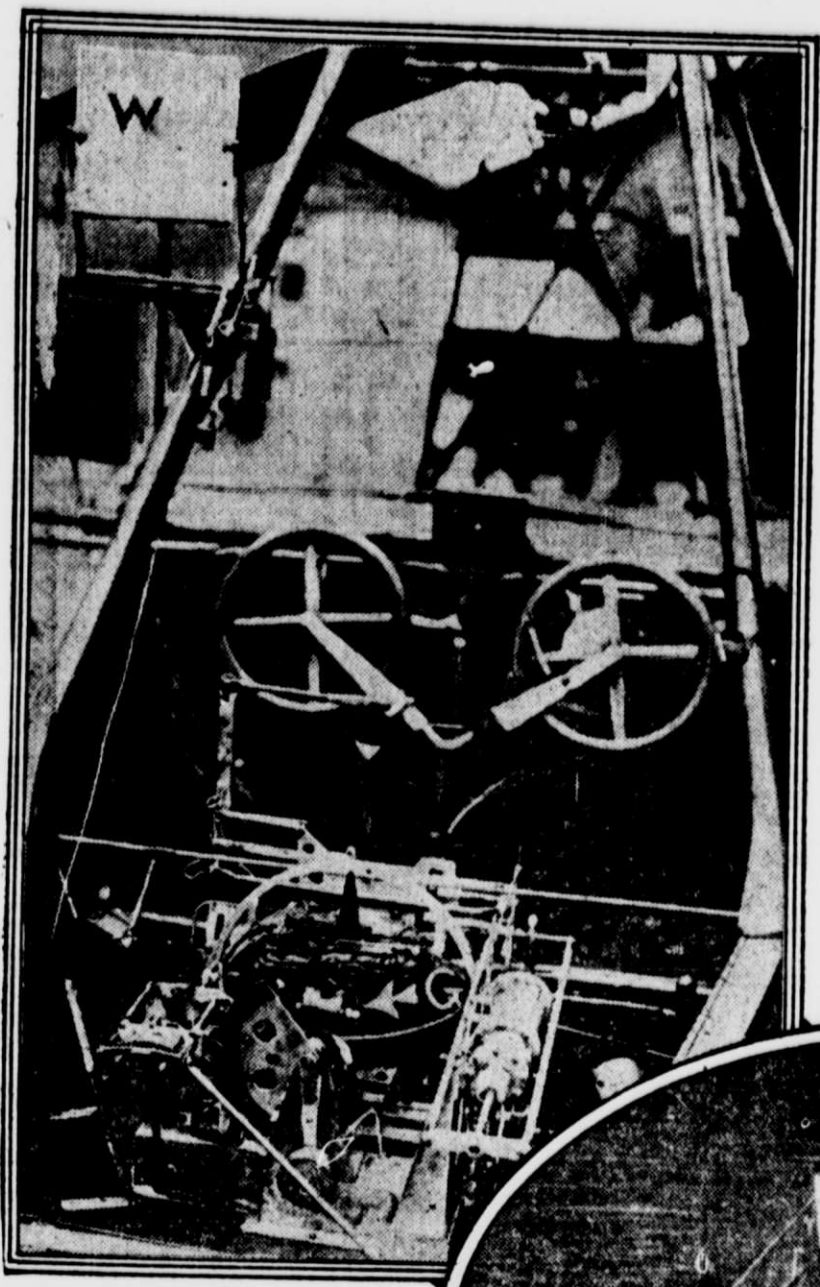
Elmer A. Sperry recognized about four years ago that something must be done to relieve the aviator of needless duties in order that he might have more time to navigate his machine and to be free to take the observations demanded of a military pilot. Unquestionably Mr. Sperry's aim was to increase the value of the flying machine as an instrument of war, but what he has actually accomplished adds enormously to its potential value as a commercial and sporting craft. From the beginning he believed the gyroscope had in it the needful basic element of control.

During the scores of flights in France Lawrence Sperry subjected his automatically stabilized Curtiss biplane to rigorous tests. While 600 feet up in the air he got out of his seat, leaving the steering wheel, and stood up. After taking this position his mechanic crawled out on the wings laterally to a distance of nearly seven feet, thus creating an upsetting force which would have meant sure death under ordinary circumstances. Nevertheless the hydro-aeroplane went smoothly on, controlling itself the while, the stabilizer shifting the ailerons at the wing tips so as to create a compensating pressure at the end of the planes furthest from the venturouse mechanism.

This deliberate disturbance was the equivalent of a tipping movement that might be set up by a heavy sideways gust of wind. It looked like a spectacular display of nerve on the part of young Mr. Sperry and his mechanic, but they had learned just how far they could tax the stabilizer and find it equal to the demand.

Not content with this proof of lateral stability, Lawrence Sperry again shifted his own weight and his six feet of athletic youthfulness by getting out of his control seat and standing as before, thereby leaving the maneuvering of the machine to its own impulse. Next, the mechanic crept back toward the tail, but in spite of that shift of weight the hydro-aeroplane kept its poise undisturbed, the longitudinal stabilizing gyros manipulating the tail planes or elevators to the necessary degree. None of the other competitors made any effort toward simulating these remarkable performances, and yet these manoeuvres really were fairly tame beside others which young Mr. Sperry accomplished.

In describing a circle or when making any sharp turn in flight the aeroplane heels over to a conspicuous degree just as a soaring bird does. In aviation parlance this is called banking, the aero-



The Sperry stabilizer as installed in the boat of the Curtiss hydro-aeroplane. Total weight of installation about thirty pounds. G, one of the four little gyros. W, the wind disc or "palette," controlling the automatic volplaning apparatus. When required, by pressing a button on the steering wheel the pilot can throw the stabilizer out of control for the moment.

plane resting the while, so to speak, upon a sloping bank of sweeping air. If through faulty control this angle be overgreat there is the danger of the craft dropping sideways in a sheer plunge earthward.

This peril is increased by the changed duties imposed upon the rudder and the elevating tail planes. Because of the sharp heel the vertical rudder is swung over so that it virtually becomes an elevator, while the elevator has usurped the functions of the rudder. The result is the angle at which the rudder is set may cause the machine to dive unexpectedly, and the aviator in making his turn must divide his attention between his wing planes and the confusing actions of the rudder and the tail planes. Uncertainty or nervousness at just such a moment has probably caused the sacrifice of a number of lives and injured many pilots who were otherwise fortunate enough to escape.

During one of the demonstrations young Mr. Sperry took aloft with him a noted French aviation authority, René Quinton, president of the National Aerial League. The day chosen for the flight was rather tempestuous and the wind was so strong that the smoke was swept horizontally away from the chimney tops of nearby factories. Quinton has described his experience, and a part of his story is well worth quoting:

"Just after starting the pilot began to ascend, and in a few minutes he took his hands from the wheel. As he passed in front of the stand holding the members of the committee Mr. Sperry raised both of his hands in the air, showing that he was exercising no control over the craft. I saw this with my own eyes.

"The aeroplane continued to rise. When we reached a height of about eight hundred feet we volplaned without the aid of the hand control. Ordinarily when aviators want to vol-



Showing manner in which a gyroscope is hung in swinging rings. The little flywheel will maintain its plane of rotation even though supporting rings are moved. Gyros in stabilizer are hung in same way and thus maintain their level constantly.

plane they have to shoot the machine almost straight down for a while in order to get the necessary sustaining speed with the motor shut off. Could the Sperry machine do this without the aid of human guidance? Mr. Sperry proved that it could.

What a Stabilizer Is, How it Helps the Airman Navigate His Machine--Mr. Sperry's Success in France

"He told me what he was going to do, stopped the motor and lifted his hands in the air. For five or six seconds nothing happened. The aeroplane seemed to be motionless. Then suddenly the speed diminished and the machine dived like a dolphin."

"Mr. Sperry showed me another trick. For nearly half a mile the machine flew and climbed at an angle of forty-five degrees, and yet the pilot never touched the wheel. The machine guided itself, and it is worthy of remark that in this abnormal position furious gusts of wind had not the slightest effect on its position. It defended itself automatically against the wind."

"One of the great advantages of the stabilizer is shown when banking on a turn. In machines manipulated by the ordinary hand controls it is necessary when turning to use three controls which govern the rudder, the lateral dip of the machine and the fore and aft rise or fall. It is the complexity of this combined functioning which makes it dangerous in the hands of any but the most expert. With the stabilizer in service, however, it is only necessary to think of the rudder; the little gyroscopes look out for everything else, leaving the pilot's mind at ease. All he has to do is to steer to right or left."

How does Mr. Sperry make his gyroscopes do this astonishing work? Each little gyro is spun up by its own tiny electric motor to a speed of about 12,000 revolutions a minute. This velocity of rotation imparts to the flywheel a certain obliquity; it resists any external effort tending to disturb its plane of

rotation. By using for each group two oppositely spinning gyros and gearing together one of the supporting rings of each, they mutually antagonized each other, in that way being insensitive to motions in those two planes. This leaves them free to act in concert only in one direction, that direction being the one of Mr. Sperry's choosing. Thus each pair of gyros tends to limit its corrective function to the longitudinal or the lateral plane, as the case may be, and to be utterly indifferent to the forces that arouse to service the other set.

As originally installed each pair was located separately, and it was found that under some conditions the gyros acquired a swinging motion something like a pendulum, and this impaired their righting efficiency. By grouping them in the one set of supporting rings this tendency has been overcome through the mutual interaction which is thus obtained.

But how do they actually stabilize the aeroplane? Of course, you can realize that little spinning wheels of but a few pounds in weight cannot generate energy equivalent to the pull and push of an aviator's arm or the rocking of his body, which is utilized to work the wing tips ordinarily. They are really little sentinels which, by maintaining their own planes of rotation, steadfastly make and break electrical contacts as the whole flying machine tends to oscillate about them as centres. The making and breaking of these contacts open and close the motive electric current which feeds a servo motor.

fall through any cause or if his motor should stop. The guardian of this mechanism is a thin plate of metal or wind disk akin to the palette employed by Douthe. The wind disk is so pivoted at its back that it will always present its face squarely against the oncoming air current as the aeroplane advances. The pressure on this plate is measured by the resistance of a spring, and that pressure, converted into its equivalent of miles per hour, is shown by an indicator in front of the pilot.

This gives him a knowledge of how fast he is going and also warns him when the speed drops near to that below which the air pressure will not keep the plane soaring or aloft. To guard him against the consequences of this non-supporting speed the wind plate has another service to perform in the direction of automatic safety.

When climbing too quickly, the angle of ascent reducing too much the supporting speed of advance, the little disk feels the slackened headway and before the danger point is reached turns the tail plane downward so as to lift that end and to start the machine volplaning at a goodly angle. By this dive the aeroplane acquires added velocity and is soon travelling at a speed admitting of safe control.

The aviator cannot check this involuntary movement until a certain prescribed speed has been attained in this fashion. By this manoeuvre the peril of slipping earthward tail first is eliminated. The automatic volplaning apparatus would be similarly called into play should the engine go wrong and stop, as happened here recently to Frank H. Burnside and his wife when 3,000 feet up in the air over the Hudson. By great good luck Burnside was able to exercise some measure of control over his craft, and after a daring descent the machine hit the river, the boat body of the hydro-aeroplane remaining intact after the plunge and thus saving the machine and its passengers.

As Elmer A. Sperry, the inventor, has said, "Nothing short of the collapse of his machine need cause the aviator now any worry--the stabilizer will take care of him automatically under all conditions of the air. His function now will, indeed, be properly and well high only that of a pilot as commonly understood." Lieut. Porte is especially desirous of obtaining a Sperry stabilizer for the America. He knows that his success depends upon his finding a way spot, the Azores, in the broad Atlantic. He wants his mind free to be centred upon that navigational problem, and the stabilizer will help him immensely in this particular.

NEW YORK LIFE.

"I heard a funny one yesterday," said a member of the Society of Automobile Engineers of America. "I was standing at Broadway and Fifty-sixth street when one of the cyclical family came spinning along as large as life and twice as sassy."

"It wasn't much bigger than a baby wagon, but it was going all right, and a man crossing Broadway jumped out of its way as though it filled the whole street and landed on the curb near me. There was a roughneck sort of a chap there watching him, and as he came up on the sidewalk the big fellow looked at him scornfully."

"Say," he said, "what did you see run for? Why didn't you kick the fustick in the face?"

"I thought about the same way, but I guess I would have run just as the other man did. You see it has got to be the habit with all of us."

This is a chronicle of Riverside Drive on the river side. The lady was rather diaphanously draped, as is the present mode, and pretty of face and figure. She was also cute enough to be contagious.

"For the life of me," she was saying, "I cannot understand why it is that so many gentlemen occupy the benches along the promenade here in the afternoon and why all the benches are turned to face the setting sun. It seems to me that the light would hurt their eyes and they would prefer to sit with their backs to it. I'm sure I would, or any other woman wishing to be comfortable."

Then she shook out her skirts so the sun wouldn't shine through and tripped tidily along.

REDUCTION CURE AT CARLSBAD MAY BE TAKEN AT HOME---IF YOU HAVE IRON WILL

CARLSBAD is full of rich Americans.

The fat man's Mecca, the renovator of acid charged blood, corrector of the wayward liver--Carlsbad is the most advertised watering place of the European continent.

Everybody stays three weeks. Even in the boarding villas, which can accommodate 20,000 guests and charge about the same as first class hotels in Paris, if you attempt to leave during your first or second week you must

nevertheless pay for the full three weeks because it is the law. Certainly it is possible to make a special agreement in writing, but no one thinks of it.

Another amusement is paying taxes. Whoever stays more than a week in Carlsbad--and this means everybody--must pay for the privileges of the town. According to your seeming wealth you are set down as first class, second class or third class. Of the first class are princes, crowned heads and all Americans. The second class consists of wealthy Germans and citizens of Europe, while the third class is composed

The Routine Declared to Be the Great Thing at the Famous Mecca of the Stout, Where You Are Compelled to Stay Three Weeks and Pay Taxes

of Europeans who are poor and look it.

I did not feel justified in remaining first class, as they put me down, so I went to the burghermeister to protest. He looked at my necktie. I had a pin in it worth \$3, a present from a millionaire friend to whom I had rendered great and vital services in Paris, and looking at that pin he said there was

nothing to be done. Fourteen florins (\$7).

And it is nothing new. Five hundred years ago the Florentine Poggio, witty, learned and pious inventor of the short story, took part in the Council of Constance as secretary of briefs to Pope John XXIII. The Council lasted three years; and the great dinners that Poggio was forced to eat so increased his weight that he "could scarce get into his chaises." Whence his season at Carlsbad in the year 1418, of which he left a curious account.

Princes and rich merchants paid the same cure tax. For privacy in bathing they rented suites of rooms in houses which possessed their own baths of hot Sprudel water. Two public baths were entered from surrounding balconies, from which spectators called down good natured advice. And even the rich, when they required mud baths, were forced to seek themselves in the Big Mud or the Little Mud along with any one to whom the Carlsbad doctors of 1418 prescribed mud.

There was not mud enough to be private. It is better now. And Carlsbad mud is muddier than other mud; so the custom was perfectly modest in the old times. Nowadays they put the millionaire in a bathtub and throw mud at him. When it is up to his neck they let him lie soft and think of what he will eat when he gets to Paris.

The Carlsbad hot baths proper are taken directly from ten principal springs--Sprudel, Hysela, Neubrunner, &c.--in the true Carlsbad cure houses. Other establishments supply Russian, Swedish, Turkish, Greek, Siberian and all other known baths and treatments for obesity, gout and rheumatism. Yet in these modern times nobody really

relied on lying in a bath to "fall out of fat."

Really to "fall out of fat" you must labor and suffer--even in Carlsbad. And here is the merit of Poggio. The Florentine of 1418 observes that any one can do a Carlsbad cure at home--and says that he did it two years later.

The plan is to rise very early in the morning, start for the springs, drink a cup of Sprudel water, walk fifteen miles and repeat. Four cups of Sprudel are thus taken before breakfast and after the last cup you are glad to walk for forty minutes, as the law directs.

Consulting your watch as you toll along the hilly ways, you stop at once

when the forty minutes have expired. No matter where you stop, there is a restaurant. There you have coffee and two soft boiled eggs, a buttered roll and a dash of Sprudel to wash it down.

For lunch there is one meat and one vegetable. In the afternoon you rest a bit, then walk a lot, then fall down in a faint upon the mountainside, to be revived by fair young maidens who sit around with bottles of smelling salts all ready and expect a handsome tip. There is more walking, more sweating done in and around Carlsbad than in all the rest of Europe.

Toward 5 or 6 o'clock every one takes a light supper. It consists of a little cold meat in extremely thin slices with toast and tea. Everybody goes to bed at 9 P. M.

People who have gone for years to Carlsbad and saved their lives a dozen times declare there is no special virtue

in the baths, but that the routine is the thing. There is nothing that one could not do at home. Any one with an iron will can follow out the simple dietary regulations I have mentioned. Only, they say, no one will do this thing at home without the stimulus of example. Otherwise the poorest fat clerk (or the fattest poor clerk) could make a Carlsbad of his home and come out brisk and fit after three weeks of treatment.

The proof that the regime is the thing is found in Marienbad, only forty miles away.

The Marienbad regime is stricter--that is all. The Carlsbad regime does not preclude an occasional square meal and it is possible to break the monotony of the cure process by rare dejeuners and dinner parties, but in Marienbad, according to the authority of one hotel keeper, "we have nothing of the kind, because no one eats anything."



When Poggio went to Carlsbad in 1418 the two public baths, frequented by the two sexes respectively, were entered by surrounding balconies, from which spectators called down good natured advice.



"Carlsbad mud is muddier than other mud, so it was perfectly modest in the old times."